

REMARKS

The present amendment amends claims 11, 16, and 30. These changes correct minor typographical errors or the like and are not intended to narrow the claims in any way.

In the present Office Action, the Examiner requested an election of species from the following groups: Embodiment 1 described in page 5 line 9 to page 5 line 20; Embodiment 2 described in page 5 line 21 to page 6 line 1; Embodiment 3 described in page 6 line 2 to page 6 line 6; Embodiment 4 described in page 6 line 7 to page 6 line 12. In response, the applicants elect Embodiment 1, with traverse.

The undersigned would like to thank Examiners Thomas and Magee for taking the time to discuss this Office Action on Thursday, 12 December 2002. The undersigned explained that he does not understand how the Examiners expect the claims to be divided given that at least some of the claims include limitations not specifically called out in any of the identified paragraphs. Examiner Thomas suggested that defining the embodiments in relation to individual paragraphs in the Brief Summary section was for ease of reference and that the embodiment defined in the relevant paragraph should be read with reference to the Detailed Description, as well. Although no conclusion was reached in the interviews, the undersigned appreciated Examiner Thomas's assurance that he or Examiner Magee would call if any questions remained after reviewing the present response.

The present Office Action merely identifies four species by reference to separate paragraphs in the specification and does not state any reason for requiring restriction. Applicant respectfully submits that this requirement fails to meet the Patent Office's rules and requests that the requirement be either withdrawn or substantiated as required by the rules.

Section 802.02 of the MPEP states, in relevant part, that "Restriction, a generic term, includes that practice of requiring an election between distinct inventions...and the practice relating to an election between independent inventions, for example, and

election of species." Hence, the present election requirement is merely one type of restriction requirement and must meet the MPEP's basic standards for a restriction requirement.

MPEP § 808 states that "Every requirement to restrict has two aspects, (A) the reasons (as distinguished from the mere statement of conclusion) why the inventions as claimed are either independent or distinct, and (B) the reasons for insisting upon restriction therebetween as set forth in the following sections." The importance of the first of these requirements is borne out in MPEP § 816 - "The particular reasons relied upon by the examiner for holding that the inventions as claimed are either independent or distinct should be concisely stated. The mere statement of conclusion is inadequate. The reasons upon which the conclusion is based should be given."

The present Office Action contains neither any reasons why the identified embodiments are either independent or distinct nor any reasons for insisting upon restriction, even if they were independent or distinct. Instead, the Examiner simply sets forth a "mere statement of conclusion." The undersigned respectfully submits this is inadequate under the Office's own rules and requests that the requirement be withdrawn. If the Examiner chooses to continue the restriction requirement, the undersigned requests that the Examiner state both the reasons that he believes restriction is proper and the reasons for requiring restriction, as dictated by the Patent Office's rules. Applicant would also expect the opportunity to respond to the Examiner's stated reasons for requiring restriction.

Despite the arguments set forth above, the undersigned understands that a proper response to the present Office Action must include an election of one of the specified embodiments and identify claims which read on the elected embodiment. In the event the Examiner chooses to continue the present restriction requirement, applicant elects Embodiment 1 and, as explained below, submits that all of the present claims are encompassed in this embodiment and are generic to at least two of the identified embodiments.

Reading the four paragraphs specified in the Office Action in light of the Detailed Description, as suggested by Examiner Thomas, it appears that Embodiment 1 is generic to the other three embodiments, i.e., the embodiment identified in the second paragraph on page 5 does not exclude any of the features of Embodiments 2-4. As a consequence, the undersigned concludes that Embodiment 1 is generic and all of the claims in the application read on this embodiment.

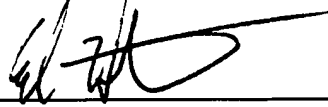
In addition, all of the claims are believed to be generic to at least two of the specified embodiments. Claim 1, for example, specifies a method that includes, *inter alia*, "subjecting the surface of the semiconductor workpiece with the deposited copper to an elevated temperature annealing process at a temperature below about 100 degrees Celsius." This limitation may exclude Embodiment 2, which refers to allowing the copper layer to self-anneal at ambient room temperature, but nothing in claim 1 excludes the further features mentioned in connection with Embodiments 3 or 4. Other claims in the application are generic to all of the identified embodiments. Hence, all of the pending claims read on Embodiment 1 and at least one of Embodiments 2-4 and are, therefore, generic.

In light of the above, the undersigned elects to begin prosecution with examination of claims 1, 3, 4, 6, 8-11, 13-17, and 24-95, all of which read on Embodiment 1. The present response is a good-faith attempt to respond to an ill-understood restriction requirement. If the undersigned has misunderstood the restriction requirement or if the Examiner would like to revise the stated requirement, the undersigned encourages the Examiner to call him to resolve this on the phone to avoid any further delay in prosecuting this application, which has been awaiting action since the undersigned met with Examiner Collins over 14 months ago.

No fees are believed due with this communication. However, the Commissioner is hereby authorized and requested to charge any deficiency in fees herein to Deposit Account No. 50-0665.

Date: 20 Dec 02

Respectfully submitted,  
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Appendix – Marked to Show Changes

In the Claims

11. (Amended) A method for filling recessed microstructures at a surface of a semiconductor workpiece with copper metal comprising:

providing a semiconductor workpiece with a feature that is to be connected with copper metallization;

applying at least one low-K dielectric layer over a surface of the semiconductor workpiece including the feature;

providing recessed microstructures in the at least one low-K dielectric layer;

preparing a surface of the workpiece including the recessed microstructures with a metal seed layer for subsequent electrochemical copper deposition;

electrochemically depositing a copper layer onto the surface of the workpiece using a process that generates copper grains that are sufficiently small to substantially fill the recessed microstructures;

annealing the electrochemically deposited copper for a predetermined period of time at an elevated temperature selected to be below a predetermined temperature at which the low-K dielectric layer would substantially degrade; and

removing copper metallization from the surface of the workpiece except from the recessed microstructures, after the annealing of the copper.

16. (Amended) A method as claimed in Claim 11 wherein ~~he~~ the step of preparing a surface of the workpiece comprises:

applying at least one adhesion layer over the dielectric layer; and

applying a metal seed layer over the adhesion layer.

30. (Amended) A method for filling recessed microstructures at a surface of a semiconductor workpiece with copper metal comprising:

providing a semiconductor workpiece with a feature that is to be connected with copper metallization;

applying at ~~lest~~least one low-K dielectric layer over a surface of the semiconductor workpiece including the feature;

providing recessed microstructures in the at least one low-K dielectric layer;

preparing a surface of the workpiece, including the recessed microstructures, with a barrier layer for subsequent electrolytic copper deposition;

electrolytically depositing a copper layer to the surface of the workpiece using an electrolytic process that generates copper grains having a size sufficiently small to substantially fill the recessed microstructures; and

subjecting the electrolytically deposited copper layer to an annealing process at a temperature below which the low-K dielectric layer substantially degrades.